

WSDOT FOP for AASHTO T 217¹

Determination of Moisture in Soils by Means of a Calcium Carbide Gas Pressure Moisture Tester

1. SCOPE

- 1.1 This method of test is intended to determine the moisture content of soils by means of a calcium carbide gas pressure moisture tester. The manufacturer's instructions shall be followed for the proper use of the equipment.
- 1.2 The following applies to all specified limits in this standard: For the purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with R 11, Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values.

Note 1: This method shall not be used on granular materials having particles large enough to affect the accuracy of the test in general any appreciable amount retained on a No. 4 (4.75 mm) sieve. The super 200 D tester is intended to be used to test aggregate.

- 1.3 The values stated in English units are to be regarded as the standard.
- 1.4 Refer to R 16 for regulatory information for chemicals.

2. REFERENCED DOCUMENT

2.1 AASHTO Standards:

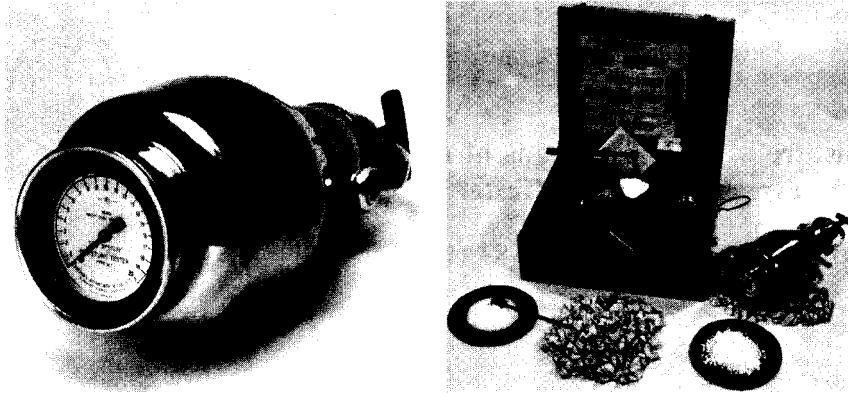
R 11, Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values

T 265, Laboratory Determination of Moisture Content of Soils

3. APPARATUS

- 3.1 Calcium carbide pressure moisture test – a chamber with attached pressure gage for the water content of specimens having a mass of at least 20 g. (Figure 1).
Those "Speed Moisture Testers" which use a 20 g sample may be used to test aggregates and soil-aggregate mixtures where the maximum particle size is $\frac{3}{4}$ in. (20 mm) or less.
- 3.2 Balance – shall conform to AASHTO M 231, Class G-2.
- 3.3 Two 1.25-in. (31.75-mm) steel balls
- 3.4 Cleaning brush and cloth.
- 3.5 Scoop for measuring calcium carbide reagent.

¹ This FOP is based on AASHTO T 217-02



Calcium Carbide Gas Pressure Moisture Meter

Figure 1

4. MATERIAL

4.1 Calcium carbide reagent.

Note 2: The calcium carbide must be finely pulverized and should be of a grade capable of producing acetylene gas in the amount of at least 2.25 ft³/lb (0.14 m³/kg) of carbide.

Note 3: ~~The “shelf life” of the calcium carbide reagent is limited, so it should be used according to the manufacturer’s recommendations.~~ When a can of calcium carbide is opened, it shall be dated. After 3 months of use, or if the can becomes contaminated, it shall be discarded.

5. PROCEDURE

- 5.1 When using the 20 g or 26 g tester, place three scoops (approximately 24 g) of calcium carbide in the body of the moisture tester (or per the manufacturers recommendations). When using the super 200 D tester to test aggregate, place six scoops (approximately 48 g) of calcium carbide in the body of the moisture tester.

Note 4: Care must be exercised to prevent the calcium carbide from coming into direct contact with water.

- 5.2 Weigh a sample of the exact mass specified by the manufacturer of the instrument in the balance provided, and place the sample in the cap of the tester. When using the 20-g or 26-g size tester, place two 1.25-in. (31.75-mm) steel balls in the body of the tester with the calcium carbide (or per the manufacturers recommendations).

Note 5: Manufacturer’s instructions shall be followed for the use of steel balls, particularly when testing sand.

Note 6: If the moisture content of the sample exceeds the limit of the pressure gage (12 percent moisture for aggregate tester to 20-percent moisture for soil tester), a one-half size sample must be used and the dial reading must be multiplied by 2. This proportional method is not directly applicable to the dry mass percent scale on the super 200 D tester.

- 5.3 With the pressure vessel in an approximately horizontal position, insert the cap in the pressure vessel and seal the unit by tightening the clamp, taking care that no carbide comes in contact with the soil until a complete seal is achieved.
- 5.4 Raise the moisture tester to a vertical position so that the soil in the cap will fall into the pressure vessel.
- 5.5 Shake the instrument vigorously so that all lumps will be broken up to permit the calcium carbide to react with all available free moisture. When steel balls are being used in the tester and when using the large tester to test aggregate, the instrument should be shaken with a rotating motion so the steel balls or aggregate will not damage the instrument or cause soil particles to become embedded in the orifice leading to the pressure diaphragm.

Note 7: Shaking should continue for at least 60 seconds with granular soils and for up to 180 seconds for other soils so as to permit complete reaction between the calcium carbide and the free moisture. Time should be permitted to allow dissipation of the heat generated by the chemical reaction.

- 5.6 When the needle stops moving, read the dial while holding the instrument in a horizontal position at eye level.
- 5.7 Record the sample mass and the dial reading.
- 5.8 With the cap of the instrument pointed away from the operator, and away from open flame or source of ignition, slowly release the gas pressure. Empty the pressure vessel and examine the material for lumps. If the sample is not completely pulverized, the test should be repeated using a new sample. Clean the cap thoroughly of all carbide and soil before running another test.

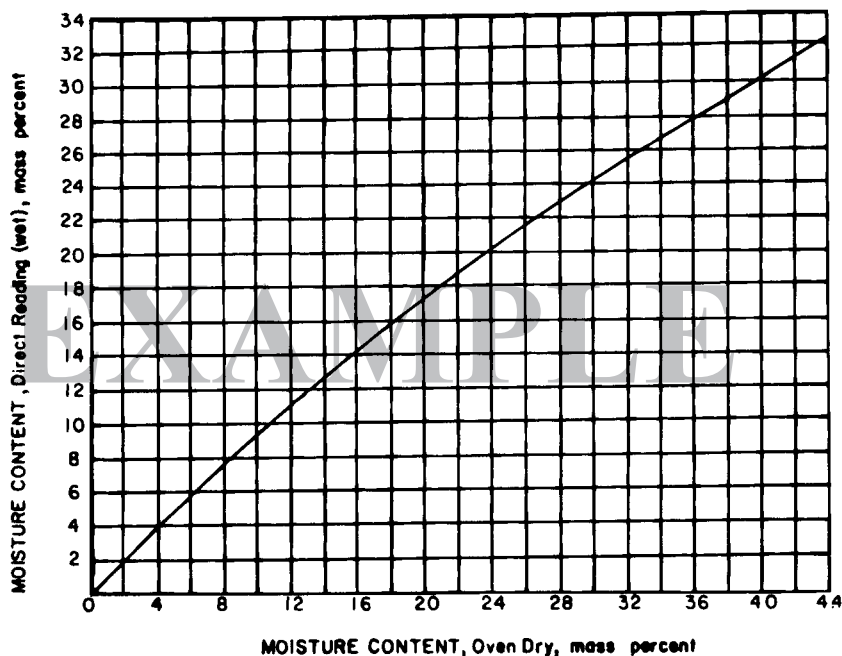
Note 8: When removing the cap, care should be taken to point the instrument away from the operator to avoid breathing the fumes, and away from any potential source of ignition for the acetylene gas.

- 5.9 The dial reading is the percent of moisture by wet mass and must be converted to dry mass. With the super 200 D tester the dial reading is the percent of moisture by dry mass, and no further calculation is required.

6. CALCULATION

- 6.1 The percentage of moisture by dry mass of the soil may be determined from a correction curve similar to Figure 2.
- 6.2 A correction curve similar to Figure 2 is normally supplied with each moisture tester. ~~Each moisture tester, however, should be checked for the accuracy of its gage, and for the accuracy of its correction curve.~~
- 5.2.1 ~~The accuracy of the moisture tester gage should be checked by using a calibration kit (available from the manufacturer), equipped with a standard gage. In case of discrepancy, the gage on the tester should be adjusted to conform with the standard gage.~~

- 5.2.2 ~~The accuracy of the correction curve should be checked by comparing curve-corrected moisture contents to moisture contents of locally prepared soils determined using T 265. In case of discrepancy, develop a new correction curve based on moisture contents determined from T 265.~~
- 5.2.3 ~~The range of the factory-supplied or laboratory-determined curves may be extended by additional testing.~~



Conversion Curve for Moisture Tester Reading
Figure 2

Figure 2 —Correction Curve for Moisture Tester Reading (Example Only—Use curve provided by the manufacturer with the specific apparatus, or a correction curve calibrated or extended for local soils at known moisture contents determined in accordance with 6.2.)

Note 9: It may be more convenient for field use of the apparatus to prepare a table of moisture tester readings versus oven-dry moisture content for the moisture tester.

- 6.3 Determine the percentage of moisture to the nearest whole percent.

Performance Exam Checklist

Determination of Moisture in Soils by Means of Calcium Carbide Gas Pressure Moisture Tester FOP for AASHTO T 217

Participant Name _____ Exam Date _____

Procedure Element

Yes No

Preparation

- | | | |
|--|--------------------------|--------------------------|
| 1. The tester has a copy of the current procedure on hand? | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. All equipment is functioning according to the test procedure, and if required, has the current calibration/verification tags present? | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Shelf life of calcium carbide reagent checked? | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Correct amount of reagent placed in body of tester? | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Number and size of steel balls correct? | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Correct mass of moist soil placed in cap of tester? | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Cap clamped to body with tester in horizontal position? | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Shaking done for proper time (60 seconds for granular soils, 180 seconds for other soils)? | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Shaking done without steel balls hitting cap or bottom of tester? | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Reading taken with tester in horizontal position at eye level? | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. Reading taken after gauge stops moving? | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. Gauge reading recorded? | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. Tester positioned with cap away from user and away from open flame or source of ignition before gas slowly released? | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. Moisture content on wet mass basis converted to dry mass basis? | <input type="checkbox"/> | <input type="checkbox"/> |

First attempt: Pass ☐ Fail ☐

Second attempt: Pass ☐ Fail ☐

Signature of Examiner _____

Comments:

